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Pesticide Fact Sheet Number 189: Carbofuran

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16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the the following actions has occurred.

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

17. Document Analysis a. Descriptors

Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, science findings.

b. Identifiers/Open-Ended Terms

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Pesticide Fact Sheet

Name of Chemical: Carbofuran
Reason for Issuance: Special Review--Preliminary Determination
Date Issued: January 5, 1989
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1. DESCRIPTION OF CHEMICAL

Common Name: Carbofuran

Chemical Name: 2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate

Chemical Family: Carbamate

Trade Name: Furadan®

EPA Shaughnessy Code: 090601

Chemical Abstracts Service (CAS) Number: 1563-66-2

Year of Initial Registration: 1969

Pesticide Type: Insecticide, nematicide

U.S. Producer: FMC Corporation

2. USE PATTERNS AND FORMULATIONS

Carbofuran is currently registered on a variety of fruit and field crops, vegetables, tobacco, ornamentals, and forest tree seedlings. Approximately 7 to 10 million pounds of active ingredient (lb ai) are applied to these sites per year. From 6 to 9 million lb ai of the annual usage is accounted for by the granular formulation. The carbofuran granular formulation was placed in Special Review in 1985 based on the avian hazard.

Types and Methods of Application: Aerial and ground.

Application Rates: 0.1 to 19.9 lb ai/acre (granular)
0.05 to 10.1 lb ai/acre (flowable)

Types of Formulations: Granular, flowable, and wettable powder formulations and a spike product.

3. SCIENCE FINDINGS

Chemical Characteristics:

Physically, technical carbofuran is a white crystalline solid that has a melting point of 153 to 154 °C (pure material). Carbofuran is stable under natural or acidic conditions and is unstable under alkaline conditions.

Toxicological Characteristics:

The Agency evaluated information concerning the hazard to humans from carbofuran and its major alternatives. Based on the available data, carbofuran does not appear to pose a chronic health hazard because it has not shown positive oncogenic, teratogenic, or reproductive effects. The data base is complete and is considered acceptable. The data bases for carbofuran's alternatives do not suggest adverse health effects however the data bases are not complete so a full conclusion cannot be drawn. The Agency has required that these data be submitted to complete the data bases.

Based on data on acute health effects, the acute oral hazard of carbofuran is the same order of magnitude as fonophos, phorate, and terbufos, but is less than aldicarb, and greater than the other major alternatives.

Environmental Characteristics:

The Agency also evaluated the potential for ground water contamination from carbofuran. The environmental fate data indicate that carbofuran is highly mobile and has a potential to leach. Simulation modeling supports this hypothesis. The environmental fate data indicate that under conditions of low pH and low temperature, residues of carbofuran could persist after leaching into ground water. Since these conditions are not widespread in the United States, most leaching of carbofuran will probably not result in significant concentrations at the wellhead. Monitoring information for Long Island, New York; Maryland; and Massachusetts show the highest and most frequently found residues in ground water. Concentrations above 36 parts per billion, the draft lifetime Health Advisory Level, will probably only occur in localized, worst-case situations. The Agency will be requiring the registrants to revise the product labels' ground water advisory statement.

Ecological Effects:

To evaluate the avian hazard from the granular formulation, the Agency evaluated the risk to birds based on (1) acute avian toxicity, (2) exposure, (3) field studies, (4) bird kill incidents, and (5) population effects.

Based on laboratory data, the Agency concluded that granular carbofuran is acutely toxic to birds, and that a single granule may kill a small bird. Birds are expected to be present at the time of carbofuran application. Dietary exposure occurs from direct ingestion of granules and exposure from ingestion of contaminated soil invertebrates such as earthworms. Predatory birds may be secondarily exposed to carbofuran by feeding on contaminated vertebrates such as small birds.

There were 6 field studies conducted at 11 locations that investigated the loss of birds from label-directed, soil-incorporated uses of 10G and 15G applied as band and in-furrow applications and 10G using specialized equipment. All studies consistently resulted in bird mortality, regardless of application rate or methods which employed commonly practiced techniques for soil incorporation of granules. Both direct and secondary poisoning occurred.

Bird kill incidents from direct poisoning from carbofuran granules have occurred in several crops in various areas of the country and Canada. The types of birds varied and included both migratory and nonmigratory birds. Bird mortality was frequently associated with at-planting application, but has occurred with other uses throughout the year. Direct poisoning of birds has caused over 40 reported bird kill incidents.

Secondary poisoning incidents have also occurred and involved bald eagles, red-tailed hawks, red-shouldered hawks, northern harriers, and others.

The direct and secondary bird kill incidents that have been reported underestimate the number of incidents actually taking place because of the problems associated with the reporting of bird kill incidents and with carcass removal by predators.

Populations of declining or endangered species may be present in areas where granular carbofuran is applied. The Agency cited documented population declines of the red-shouldered hawk, loggerhead shrike, field sparrow, Henslow's sparrow, and others. Statistically significant declines have been measured for several species.

While the Agency does not consider granular carbofuran to be the sole causative factor in the decline of the bird species discussed, carbofuran is one of the most highly toxic pesticides to which these birds are exposed. Given its widespread use in agriculture, carbofuran is likely to be responsible for bird deaths in these species. The Agency concluded that granular carbofuran can, therefore, be an important additive factor in the declines.

The Fish and Wildlife Service's Division of Endangered Species and Habitat Conservation (DESHC) indicated in its Biological Opinion for carbofuran that the Aplomado falcon, Attwater's greater prairie chicken, and Aleutian Canada goose were the bird species jeopardized by the use of carbofuran and indicated that the use be eliminated in certain areas. DESHC also indicated that the bald eagle, whooping crane, and Mississippi sandhill crane may be adversely affected. DESHC recommended prohibiting the use of carbofuran in certain areas to avoid impact on these species.

The Agency has examined other statutes that are intended to protect birds and that compliment FIFRA. The Migratory Bird Treaty Act prohibits the taking "by any means or in any manner" individual birds of migratory species that are listed in the Act's regulations. Birds of more than 20 such species have been reported killed by carbofuran. Likewise, the Bald and Golden Eagle Protection Act prohibits takings of the bald and golden eagles and the Endangered Species Act prohibits taking of threatened or endangered species. A number of bald eagles killed by carbofuran have been reported and the Fish and Wildlife Service has determined that carbofuran use threatens the continued existance of several endangered species.

The Agency has concluded that in general carbofuran poses the greatest risk to birds as compared with other granular pesticides, including its alternatives. This conclusion was based on estimations of the numbers of LD50s per square foot of treated ground according to labeled use rates and methods. The field studies and reported bird kill incidents for carbofuran confirm the Agency's conclusion that carbofuran poses a high risk. This approach for comparative risk analysis can be used by the Agency to identify other high risk pesticides for which regulatory action would be appropriate.

4. BENEFITS ANALYSIS

The Agency analyzed the benefits of carbofuran use on 10 sites. The percentage of granular carbofuran use on these sites is as follows: 68 percent for corn, 14 percent for sorghum, 5 percent for soybeans, 2 percent for rice, 5 percent for peanuts, and 2 percent for tobacco. Also, less

than 1 percent is used on each of the following sites: cotton, cranberries, sunflowers, and pineseed orchards. These uses encompass over 95 percent of the granular carbofuran usage and about 85 percent of all carbofuran formulation usage.

If carbofuran is not available for treatment of the 10 sites, the Agency estimated an annual grower impact that ranged from approximately $22.8 to $33.0 million. The largest economic impact from cancellation of granular carbofuran will be for rice since no registered alternatives are available for control of the rice water weevil. The Agency estimates a grower impact to be $12.2 million annually: a $6.1 million decrease in Federal deficiency payments to rice growers would indicate a loss to society of $6.1 million.

Corn is the major use site for carbofuran, and cost-effective, efficacious alternatives are available. No changes in costs of production, yields, or revenues are expected. The corn insecticide market is highly competitive, and viable alternatives with similar pesticide performance are available at comparable cost per acre.

The carbofuran market for corn has been declining since 1978, and current usage is approximately one-third the level it was in 1978. By 1986, the market share held by carbofuran dropped to less than 15 percent where, in terms of acre treatments, it ranked fourth out of the five major corn insecticides. The reasons for the decline are not clear, but could include loss in efficacy, spectrum of control, and others.

Carbofuran is applied to nonflooded cranberries in Washington and Oregon to control the black vine weevil. Carbofuran is the only pesticide registered for black vine weevil larvae control. Acephate is an efficacious insecticide for control of the adults. The impact on cranberries, without considering acephate's use, is expected to occur over a 7-year period due to the perennial nature of the crop. Overall impacts could range from $7 million to $7.7 million over this period.

For the remaining crops, the Agency does not anticipate major impacts. The overall economic impact from cancellation is not expected to result in significant changes in either production costs or outputs.

The Agency also evaluated aspects of carbofuran use that are not easily quantifiable. For example, only one carbamate (trimethacarb) would be available for corn growers who rotate organophosphate and carbamate insecticides to delay development of resistance in soil pests, although the Agency recognizes that some cross-resistance with organophosphates could occur. Also, carbofuran has

residual and systemic properties and a broad spectrum of control. However, repeated use of carbofuran may lead to an apparent increase in soil microbial populations that are capable of reducing its effectiveness.

5. SUMMARY OF REGULATORY POSITION AND RATIONALE

In weighing the risks and benefits, the Agency reviewed a number of options other than cancellation to reduce the risk to birds. Among these measures were (1) additional precautionary labeling regarding the hazard to birds, (2) limiting carbofuran use to certain months of the year, (3) limiting application geographically, and (4) implementing a risk reduction program. The Agency evaluated these measures and determined that they would not adequately mitigate the risk.

As a result, the Agency is proposing to cancel granular carbofuran use on all sites. The decision to cancel granular carbofuran use is based on the conclusion that the risk to birds outweighs the benefits of use. Because of the substantial risks and substantial benefits associated with the use of carbofuran on rice to control the rice water weevil, the Agency has requested specific additional information pertaining to the associated risks, benefits, usage, and additional means of control.

6. CONTACT PERSON

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